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Method and device for erecting blanks cut from paperboard

Description

The invention relates to a method for erecting (flat) blanks for cartons, collapsible boxes, trays or the like. Said blanks are moved before an aperture of a forming shaft and introduced therein with the aid of a forming punch, which in particular can be raised and lowered, whereby certain parts of the blank, in particular those in the region of longitudinal walls and/or transverse walls of the carton or the like, are erected in the process.

In known devices of the type mentioned above, a blank is first moved in front of the aperture of a forming shaft and pushed into said shaft by the forming punch, with parts of the blank being erected or folded. Following this, the forming punch is drawn out of the forming shaft as the next blank is moved in front of the aperture of the forming shaft, and the entire process is repeated.

The object of the invention is to develop a method and a device of the aforementioned type, in particular to propose measures which result in increased operating speed.

To achieve this object, the method according to the invention is characterized in that, once the blank has been introduced into the forming shaft, the forming punch is moved at least partially out of the forming shaft to a position before the aperture thereof. In the process, the forming punch is moved, in particular pivoted, out of the forming shaft in a direction opposite to the direction in which the blanks are introduced. Preferably, therefore, the forming punch is not returned through the aperture but rather is guided at least partially in a (sub)region outside the forming shaft. This arrangement ensures that the next blank to be erected can already be moved, in particular conveyed, in front of the aperture of the forming shaft before

the forming punch has attained its initial position before the opening of the forming shaft.

Pursuant to an advantageous development of the invention, the forming shaft is assigned at least two forming punches that are moved in succession for each of them to push a (separate) blank into the forming shaft. With this arrangement the operating speed of the device can be doubled while maintaining the same speed of the forming punches. A preferred embodiment of the invention provides two forming punches which are operated offset to one another such that a second forming punch starts pressing a blank through the aperture of the forming shaft when a first forming punch has essentially finished the erection of another blank, in particular when it has transferred this blank to a conveying means employed for carrying off the at least partially erected blanks.

Preferably the input of the blanks as well as the drive of the forming punches are executed continuously, thus helping to avoid stress to the device caused by discrete cyclic operations.

A device for achieving the aforementioned object has the features of claim 10. Preferably at least two forming punches are likewise provided which can be moved in succession through the forming shaft. The forming punches are each rotatably, in particular pivotably, mounted on a carriage or slide located outside the forming shaft, which can be displaced upwards and downwards, and are preferably moved by a respective continuously-driven belt.

Preferred developments on the method and device according to the invention are disclosed in the dependent claims and the remaining description. In the following, an exemplary embodiment will be illustrated on the basis of the drawings, which show

Fig. 1 a schematic side view of a device for erecting blanks,

Fig. 2 a vertical section of the device pursuant to Fig. 1,

Fig. 3 a schematic view showing the path of movement of a forming punch of the device,

Fig. 4 a cross-sectional view through a part of the device, on an enlarged scale,

Fig. 5 schematic side view of an alternative embodiment of the device pursuant to Fig. 1,

Fig. 6 the device pursuant to Fig. 5 in a vertical sectional view along intersecting line VI-VI, and

Fig. 7 a horizontal sectional view through the device along intersecting line VII-VII in Fig. 6.

The Figures 1 to 7 show parts of a device for the cartoning of products 10. Here the products 10 are packed in trays 11. But in place of the shown trays 11, it is also possible to use other arbitrary (bundle) packages, such as cartons, collapsible boxes or the like.

The trays 11 are made from essentially flat blanks 12 made of paper, (corrugated) cardboard, plastic or the like. To this end, the blanks 12 are taken from a stack of blanks 13. The individual blanks 12 lie flat in the pile of blanks 13 and on top of one another, preferably with an essentially horizontal extension. The stack of blanks 13 can also be located in a blanks magazine from which the blanks 12 can be separately conveyed or removed.

For forming the trays 11 or cartons, collapsible boxes or the like, the blanks 12 are fed to an erecting station 14. In this station the essentially flat blanks 12 are prepared for receiving the products by erecting parts of the blank 12, for example by the folding of lateral walls or transverse walls into an upright position. In the shown exemplary embodiment, a part of the upright side wall 15 of the tray 11 is formed in the erecting station 14. Depending on the type of the package to be produced, it is also possible to erect additional side walls, in particular all side walls, in the erecting station 14.

In the following, the special features of the erecting station 14 will be described in conjunction with Figures 1 to 4 for a first exemplary embodiment.

The blanks 12 are conveyed in front of the aperture 16 of a forming shaft 17 of the erecting station 14. The aperture 16 is delimited by at least two walls of the forming shaft 17, which are arranged opposite to one another and which in a lower region are disposed in an essentially vertical direction and preferably run in a straight plane. In the region of the aperture 16, the side walls 19 open out in a funnel-like shape, preferably having a circular radius in the region of the aperture.

Continuing from this region the side walls run approximately horizontally as a support surface for the blanks 12. Two other side walls of the forming shaft 17, which has a rectangular outline, are left open to avoid interfering with the movement path of the forming punch 20. The size of the aperture 16 is dimensioned such that the blank 12 lies on the funnel-shaped side walls 19 in the region of two opposite edges. The dimension of the blank 12 transverse thereto, for example its width, is less than the clear width of the forming shaft 17.

The blanks 12 are pushed individually into the forming shaft 17 by a forming punch 20 as parts of the blank 12 are turned up as they press against the region of the forming shaft 17 where the side walls 19 narrow in a funnel-like shape in the conveying direction. The forming punch 20 retains an approximately horizontal orientation during the entire process of pushing the blanks into the forming shaft 17. The partially folded or erected blanks 12 are conveyed by the forming punch 20 downward in the forming shaft 17 in an approximately vertical direction and are immediately transferred to a conveying means 21 running below the forming shaft 17 which transports the partially folded blanks 12 out of the region of the forming shaft 17.

A first special feature of the erecting station 14 lies in the return of the forming punch 20 to a position in front of the aperture 16 of the forming shaft 17 after a blank 12 has been pushed into the forming shaft 17. After the blanks 12 have been transferred to the conveying means 21, the forming punch 20 is moved out of the forming shaft 17 and guided upwards such that the forming punch 20 is moved at least in part outside of the forming shaft 17 and returned in front of the aperture 16. By virtue of this arrangement it is possible to convey the next blank 12 into the region of the aperture 16 during the return movement of the forming punch 20. The blanks 12 can thus be moved or conveyed continuously in front of the aperture 16.

Another special feature is that the (individual) forming shaft 17 is assigned a plurality of forming punches 20, 22. The forming punches 20, 22 are passed through the forming shaft 17 in succession, with each forming punch 20, 22 pressing in each case a single blank 12 into the forming shaft 17. The forming punches 20, 22 are arranged such that they are passed through the forming shaft 17 at a (temporal and spatial) distance to one another. Provided in the shown exemplary embodiment is that as a blank 12 is being transferred by the forming

punch 22 to the conveying means 21, at approximately the same time the other forming punch 20 is pivoted in front of the aperture 16 for pushing in the following blank 12. In the case shown here, this results in a doubling of the cycle rate. The successive forming punches 20, 22 are sufficiently spaced apart such that there is enough room to move the lower forming punch 20, 22 outwards. As an alternative, it is possible to provide more than two forming punches 20, 22.

Also of significance is the manner in which forming punches 20, 22 are moved out of the forming shaft 17 (Fig. 3). After a blank 12 is transferred to the conveying means 21, the forming punches 20, 22 are first swiveled about a pivot 23 to assume an approximately vertical orientation as they move out of the forming shaft 17. The pivoting of the forming punches 20, 22 is executed counter to the direction in which the blanks 12 are pushed in. Preferably the completed swiveling movement is followed by the upward movement of the forming punches 20, 22, with the vertical orientation of the forming punches 20, 22 being retained. At an upper final position the forming punches 20, 22 are swiveled into an approximately horizontal position before the aperture 16 of the forming shaft 17. This is followed by the vertical downward movement of the forming punches 20, 22, which have an approximately horizontal orientation and preferably with their full surface on a blank 12. The movement cycle ends when the blanks 12 are transferred to the conveying means 21. Fig. 3 schematically illustrates this motion sequence for shaping stamp 22 shown in Fig. 2.

It goes without saying that forming punch 20 is moved in an analogous manner. The motion sequence of the forming punch 20 can be seen as a mirror image of the motion sequence for the forming punch 22 shown in Fig. 3, since the two forming punches 20, 22 are arranged opposite one another on the forming shaft 17. In addition, it is possible to overlay the movement of the forming punches 20, 22 in the vertical direction with their pivoting or swiveling movement.

The two forming punches 20, 22 are each driven by a separate endless conveyor. A drive motor 24 powers, by means of a drive shaft 25, two toothed belts 26 as endless conveyors which are arranged at either side of the forming shaft 17 and run in the vertical direction and which are assigned a respective forming punch 20, 22. To this end, the drive shaft 25 is coupled with a respective top cogwheel 27 which drives the toothed belt 26. The direction of movement of the toothed belts 26

run counter to each other, as indicated by the arrows in Fig. 2. Furthermore, in each case lower cogwheels 28 are provided around which the toothed belts 26 are guided. In the shown exemplary embodiment, each forming punch 20, 22 is assigned its own toothed belt 26. In the case involving more than two forming punches 20, 22, forming punches 20, 22 disposed on the same respective side of the forming shaft 17 can be driven preferably by a common toothed belt 26.

In order to move the forming punches 20, 22, the toothed belts 26 are each coupled to a carrier 29. The carriers 29 are coupled in the region of a lateral free end to the toothed belts 26. The adjacent free lateral end 30 of the carriers 29 is in addition displaceably mounted in an oval curved track 31, namely by means of a annular bearing bush 32. The curved track 31 is recessed in a bearing block 33 which otherwise has an essentially rectangular outline. This bearing block 33 extends at least over the entire height of the toothed belt 26. Another opposite lateral end 34 of the carrier 29 extends through a bore hole 35 in the forming punches 20, 22. As can be seen in Fig. 2, the forming punches 20, 22 are mounted on the carriers 29 in the region of a lateral free end of the latter. By virtue of the driving action of the toothed belt 26 about the cogwheels 27, 28, the carrier 29 is guided in the curved track 31 along the oval path of movement 36 shown in Fig. 3.

The design of the forming punches 20, 22 and the arrangement of the pivot 23 result in the advantageous path of movement 37 of the forming punches 20, 22, as shown schematically in Fig. 3. As can be seen from Fig. 2, the forming punches 22 are configured with an approximately L-shaped cross-section that features a first, longer leg 38 and a second shorter leg 39. The shorter leg 39 is also angled, or elbowed. For abutting the blank 12, the longer legs 38 of the forming punches 20, 22 have in part a rectangular or square outline. In order to reduce their weight, the forming punches 20, 22 have a center recess 40. As already described, the forming punches 20, 22 are attached to the carriers 29 in the region of a lateral end of the forming punches 20, 22, namely in the vicinity of their elbowed region. Configured in a centered position in the angled or elbowed region is also the second pivot 23. To this end, the forming punches 20, 22 are rotatably mounted on an axis 41, which in turn is mounted in a projected manner on a carriage 42 that can be moved up and down. The carriage 42 is displaceably mounted on two

guide rails 43 in an exclusively vertical direction. The guide rails 43, which are assigned to the bearing blocks 33, run on either side of the toothed belts 26. The guide rails 43 determine the path of movement of the axis 41, or pivot 23. The latter can accordingly be moved only in the vertical direction, namely upwards and downwards.

The mounting of the forming punches 20, 22 on the vertically displaceable pivot 23, or axis 41, and their additional mounting on the combination of toothed belt 26 and carriers 29, which is driven along the curved track 21, results in the movement of the forming punches 20, 22 shown in the schematic illustration in Fig. 3. The legs 38 that come to rest on the blanks 12 are pivoted in front of the aperture 16 and above the latter and moved into the forming shaft 17 as they take along and erect a single blank 12. The forming punches 20, 22 are moved downward along with the blank 12 in the forming shaft 17 until the blanks 12 come to rest on the conveying means 21. The forming punches 20, 22 are then pivoted laterally out of the forming shaft 17 counter to the vertical conveying direction of the blanks 12 and returned outside of the forming shaft 17 back to a position in front of the aperture 16 of the forming shaft 17. During this process the toothed belts 26 are driven continuously.

Following the conveying path of the blanks in the forming shaft 17 is a laterally directed transport of the partially folded blanks 12. The conveying means 21 are provided for this purpose. The conveying means 21 comprise preferably one or more parallel (endless) conveyor belts 45 that are driven by deflection rollers 46. The one or more conveyor belts 45 can be arranged below the forming shaft 17 or run partially through it.

In the shown exemplary embodiment two parallel conveying belts 45 are provided as endless conveyors whose deflection rollers 46 are arranged on a common axis. The partially folded blanks 12 are placed upon the conveyor belts 45 by the forming punches 20, 22 as described, namely precisely between carriers 48 which are disposed on the outer side of the conveyor belt 45. The carriers 48 are arranged in pairs, with the mutually facing upright side surfaces of the paired carriers 48 being tapered. The space between each pair of carriers 48 thus widens in the upward direction. The minimum distance between a pair of carriers 48 corresponds approximately to the corresponding cross-sectional dimension of the

tray 11. The conveying means 21 transports the partially folded blanks 12 laterally out of the erecting station 14. Subsequently, other side walls are erected or folded and connected to the already erected side walls 15, for example by the application of glue. The erection of the other side walls and their adhesive bonding to the side walls 15 folded in the erecting station 14 is preferably executed after the products 11 have been set down from above into or on the partially folded blank 12. The erecting or upright folding of the remaining side walls can be performed with the assistance of special folding members or folding guides. The glue is preferably applied in the region of folding flaps 49.

The described device and method for erecting the blanks 12 is preferably conducted in a completely continuous manner. This also applies to the introduction of blanks 12 from the stack of blanks 13 and the lateral transport of the partially folded blanks 12 on the conveying means 21.

Fig. 5 to 7 show a second preferred exemplary embodiment. Inasmuch as the components of this device described in the following match the functional features of the components described in the first exemplary embodiment, the same reference numbers will be used for their designation.

The device shown in the second exemplary embodiment differs from the exemplary embodiment pursuant to Fig. 1 to 4 merely with respect to the constructive design of the erecting station 14, namely with respect to the means provided for executing the movement of the forming punches 20, 22. The pushing-down movement of the forming punches 20, 22 and their withdrawal from the forming shaft 17 are essentially identical to that of the first exemplary embodiment.

As in the first exemplary embodiment, the blanks 12 are removed individually from a stack of blanks 13 and moved in front of the aperture 16 of a forming shaft 17. There the separate blanks 12 are gripped on the top by a forming punch 20, 22 and pressed into the forming shaft 17, with at least part of the blank 12 being erected. Arranged below the forming shaft 17, as in the first exemplary embodiment, is an endless conveyor comprising two parallel conveyor belts 45. Individual blanks 12 are set down by the forming punches 20, 22 between carriers 48 on the top side of the conveyor belts 45. The conveying means 21 formed by the conveyor belts 45 is preferably configured as a continuously driven endless

conveyor and serves to convey the at least partially folded or erected blanks 12 out of the erecting station 14. As in the first exemplary embodiment, the folding or erecting of the blanks 12 is completed during the further lateral or horizontal transport on the conveying means 21.

As in the first exemplary embodiment, two forming punches 20, 22 are provided. In contrast to the previous exemplary embodiment, the forming punches 20, 22 here in their horizontal projection are disposed on the same side of the forming shaft 17. Each of the forming punches 20, 22 are pivotably mounted on a carriage 50 which can be moved along a linear axis 51. The linear axes 51 in the shown exemplary embodiment assume an essentially vertical orientation so that the forming punches 20, 22 can be moved up and down along the linear axes 51 in a vertical direction. The carriages 50 are each assigned a servomotor 52 which makes it possible to swivel the forming punches 20, 22, which are mounted on the carriages 50, about a pivot 23.

With the help of the vertically displaceable carriages 50 and the pivotable forming punches 20, 22 attached thereto, it is possible to realize the motion sequence described in the first exemplary embodiment. The forming punches 20, 22 are respectively pivoted in succession to lie against a blank 12 lying flat on the side walls 19 of the forming shaft 17. By virtue of the downward movement of the carriages 50 in the essentially vertical direction, the blanks 12 are pressed individually into the forming shaft 17 as the blanks 12 are at least partially erected. During the entire process of pushing in the blanks 12, the forming punches 20, 22 assume an approximately horizontal orientation. In a lower final position of the carriages 50 the blanks 12 are transferred by the forming punches 20, 22 to the conveying means 21. The forming punches 20, 22 are then swiveled about the pivot 23 counter to their pressing-down movement and moved out of the forming shaft 17 to assume an upright, essentially vertical position. The carriages 50 are then moved upwards until they reach an upper end position with the essentially vertical orientation of the forming punches 20, 22 being maintained. Finally, the forming punches 20, 22 are moved in their pressing-down direction to assume an approximately horizontal position in which the forming punches 20, 22 lie on the top side of the blanks 12 at the height of the aperture 16 of the forming shaft 17.

As in the first exemplary embodiment, the forming punches 20, 22 are moved through the forming shaft 17 spaced or offset from one another in time and distance such that after a lower forming punch 22 swivels back, the upper forming punch 20 can be moved along with a blank 12 into the forming shaft 17. The forming punches 20, 22 can thus be returned to an upper initial position while the respective other forming punch 20, 22 is already passing through the forming shaft 17. As in the first exemplary embodiment, this arrangement achieves a doubling of the cycle rate. As in the first exemplary embodiment, the forming punches 20, 22 are swiveled back counter to the pressing-in direction of the blanks. The forming punches 20, 22 are moved back in front of the aperture 16, as in the first exemplary embodiment, essentially outside of the forming shaft 17. Depending on the length of the vertical path of movement of the forming punches 20, 22, the swiveling movement can also be combined with the upwards or downwards movement.

The linear axes 51 each contain endless conveyors, for example continuously driven toothed belts, drive belts or the like, which are respectively guided around a lower deflection roller 53 and an upper, common transmission shaft 54. The two circulating conveyor belts in the linear axes 51 are driven by a common servomotor 55 that is coupled with the transmission shaft 54. The mutually opposite movement of the two forming punches 20, 22 results from the respective arrangement of the carriages 50 on the opposing conveyor strands of the respective endless conveyors of the linear axes 51. The carriage 50 associated with the forming punch 20 is arranged on a conveyor strand facing the forming shaft 17, while the carriage 50 associated with the forming punch 22 is arranged on conveyor strand of the linear axis 51 facing away from the forming shaft 17 (Fig. 7).

As can also be seen from Fig. 7, the two linear axes in their horizontal projection are arranged on the same side of the conveying belt 45 of the conveying means 21. One linear axis 51 is arranged approximately at the height of the forming shaft 17, whereas the second linear axis 51, which in the shown exemplary embodiment moves the forming punch 20, is laterally offset to the forming shaft 17. Because of this arrangement the arms 56, 57 which connect the forming punches 20, 22 to their respective carriages 50 are have a multi-angled or elbowed configuration. In

the shown exemplary embodiment, the arms 56, 57 each have a double-angle configuration, as seen in their horizontal projection and from the side view, for bridging the space between the linear axes 51 and the forming shaft 17.

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List of designations

10	product
11	tray
12	blank
13	stack of blanks
14	erecting station
15	lateral wall
16	aperture
17	forming shaft
19	side wall
20	forming punch
21	conveying means
22	forming punch
23	pivot
24	drive motor
25	drive shaft
26	toothed belt
27	cogwheel
28	cogwheel
29	carrier
30	lateral end
31	curved track
32	bearing bush
33	bearing block
34	lateral end
35	bore hole
36	path of movement
37	path of movement
38	leg
39	leg
40	recess
41	axis
42	carriage
43	guide rail
44	recess
45	conveyor belt
46	deflection roller
47	axis
48	carrier
49	folding flap
50	carriage
51	linear axis
52	servomotor
53	deflection roller
54	transmission shaft
55	servomotor
56	arm
57	arm